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Propelling Ships, Propellors, Paddle-wheels, and Screws.—J. M. Rogers, 3216. H. J. Haddan, (com.), 3359. G. W. von Nawrocki, (com.), 3447.

Pulleys.—J. B. Rogers, 3207.

Pumps, Pumping and Raising Water and other. Liquids, Pumps, Pistons, and Packing.—J. C. A. Rohde 3349. W. Jagger, 3368. W. Weyhe, 3372. J. Cameron, 3434. G. Massey, 3437. G. Hartley, and J. Greenhough, 3432. J. Cougnet, and A. P. Potel, 3545.

Punching and Perforating.—J. Fulton, 3177. W. Arrol, 3467.

Purses and Purse Fastenings.—F. Wirth (com.), 3375. R. H. Allan, 3540.

Rags and Waste, Separating Fibres from Fabrics.—W. S. Shepherd, 3410. G. C. Lister, 3421.

Railways, Permanent Way, Rail Joints, Chairs and Sleepers, Portable Railways, Atmospheric ailways, Switches, points, Crossings, and Turntables.—J. S. Williams, 3256. G. H. Adam, 3300. E. C. F. Mathieson, and L. Harty, 3535. J. Rogers, 3544.

Railways, Carriages, Coupling, Uncoupling and Altering Position of Carriages and Engines.—T. Powell, 3225. C. D. Able (com.), 3261. J. D. Camm, 3322· W. T. Cooke, 3524.

Reaping, Mowing, Making Hay, Gathering in Produce.—W. J. and C. T. Burgess, 3195. W. Mc J. Cranston (com.), 3269. W. E. Gedge (com.), 3360. F. T. Hancock and E. C. Hennah, 3401. W. Allan, 3417. J. Simpson, 3470.

Reflectors, for Lamps &c.—B. J. F. Voss, 3456.

Refrigerating, Cooling Liquids, Making Ice.—W. Hargreaves and W. Inglis, 3340. F. Wirth (com.), 3346. G. C. Roberts, 3398.

Registering, Indicating, and marking.—P. Auld, 3255. J. Britten, 3287. C. F. Hayes, 3326. V. Milward, 3358. G. Hartley and J. Greenhough, 3422. G. W. von Nawrocki (com.), 3500.

Road making and paving, Cleaning Streets.—W. Richter, 3201. W. Richier, 3221. J. W. Dennison, 3339. J. Hodges and J. W. Butler, 3509.

Ropes, Cordage, Twine, Oakum, Wire Ropes.—G. W. von Nawrocki (com.), 3384.

Sewing and Embroidering.—E. Ward, 3178' E. Wisemen, 3267. J. Warwick, 3286. W. Mc' J. Cranston (com.), 3443. E. T. Hughes (com.)' 3452.

Shears, Scissors, Clipping and Shearing Animals.—J. Trickett, 3381.

Ship and Boatbuilding.—W. H. Crispin, 3217. J. I. Thornycroft, 3297. G. W. von Nawrocki (com.), 3447. W. Arrol, 3467. A. Wilson, 3472. F. W. Phillips, 3504. J. Yates, 3526.

Ships Cargoes, (Loading and Unloading).—C. D. Abel (com.), 3261. T. Robinson, 3489.

Ship's Rigging and Sails, Reefing and Furling Sails.—J. B. Rogers, 3207.

Shirts, Collars Wristbands,&c.—C. L. M. Koedt, 3288. G. McDonald, 3457.

Shot, Shell, Bullets, and other Projectiles.—G. Wilson, 3196. R. Hadfield, 3307. T. E. Vickers, 3433. J. B. Pearse (com.), 3493.

Sifting, Sorting, Separating.—R. Pritt and W. Hind, 3424.

Signals, Alarms, Communicating Apparatus, Conveying Sounds.—C. T. Starley and H. Triggs, 3169. W. Walton, 3211. G. W. Smith, 3246. W. H. Watson, 3264. J. Feather and C. J. Thurlow, 3301. H. Gardner (com.), 3505.

Skates, Skating Rinks.—J. P. Becker, 3343. J. P. Becker, 3351. J. P. Becker, 3352.

Spindles; Spindles and Flyers.—E. A. Cowper, 3230. D. R. Malcolm, 3262. S. B. Ardrey, 3271. C. and J. Greenwood, 3354.

Spinning and Preparing for Spinning.—W. Calvert, 3180. W. Ireland, 3227. G. W. Robertson: 3228. E. A Cowper, 3230. E. Edwards (com.), 3242. J. McKean and R. H. Collyer, 3257. G. Baxter, 3259. W. Morgan-Brown (com.), 3263. S. B. Ardrey, 3271. T. Craven, 3273. W. H. Wright, 3274. J. C. Mewburn (com.), 3290. T. F. Johnson, A. Staples, and E. Baradell, 3345. G. and J. Greenwood, 3354. F. Wirth (com.), 3377. J. Bullough, J. Smalley, and S. Tweedale, 3380. J. Blackburn and H. Butler, 3396. S. C. Lister, 3421. J. C. Mewburn (com.), 3441. S. Kellett, 3466. J. A. Bright (com.), 3484.

Springs.—W. E. Newton (com), 3179. E. McCann, 3247. G. McDonald, 3457. W. T. Cooke, 3524.

Stamps and Stamping, &c.—W. A. Rollins, 3243. W. R. Lake (com.), 3344. G. W. von Nawrocki (com.), 3500.

Steam and other Boilers, Cleaning and Preventing Incrustation of Boilers, Water Feeding Apparatus for Boilers.—H. P. Rieth (com.), 3185. J. E. C. Lueues, 3232. T. Feather and C. J. Thurlow, 3301. C. J. Galloway, 3371. J. Bean, 3411. M. J. Roberts, 3428. R. Williams, 3534.

Steam Engines (Stationary, Locomotive, and Marine.)—A. Morton, 3167. H. P. Rieth (com.), 3185. J. Shanks and J. G. Lyon, 3237, W. Clarke (com.), 3251. F. Wirth (com.), 3316. D. Frazer, 3329. W. Lishman and J. Young, 3338. W. Hargreaves and W. Inglis, 3340. W. Jagger, 3368. W. Weiyhe, 3372. J. Starley, 3388. J. H. and F. Butterfield, 3439. K. W. Jurisch and J. H. Lewis, 3462. W. Bow, 3473. W. T. Cooke, 3524.

Steering or Guiding Ships, Carriages, Ploughs, &c.—H. J. Haddan (com.), 3359. G. W. Allen, 3391.

Stone and Slate, Artificial Stone and Marble, Grindstones and Millstones.—J. H. Johnson (com.), 3268. S. T. Rawlings, 3390. J. A Ditch, 3460. J. Hodges and J. W. Butler 3509.

Straps, Driving Bands, and Belting for Machinery.—G. W. von Nawrocki, (com.), 3384. H. B. Barlow (com.), 3436.

Surgery, Surgical Instruments, &c.—N Rheinberg, 3320. W. R. Lake (com.), 3613.

Syringes.—H. Conradi (com.), 3295.

Telegraphs; Telegraph Printing Apparatus.—L. A. Brasseur and S. W. M. de Sussex, 3487.

Testing the Strength and Quality of Materials.—G. W. von Nawrocki com.), 3293. J. L. Pulvermacher, 3469.

Threads and Yarns.—W. Morgan-Brown (com.), 3263. T. Craven, 3273.

Tobacco and Snuff, Cigars, Cigar-holders, Pipe and Cigar-lighters, Smoking-pipes, Tobacco-pouches.—G. T. Parkins and W. Moore, 3183.

Tools.—S. T. Rawlings, 3390.

Torpedoes.—J. I. Thornycroft, 3297.

Toys.—J. H. Johnson (com.), 3479.

Tramways and Tramway Carriages, Tramway Locomotives—W. Clark (com.), 3276. S. W. Nergent, 3292.

Trimmings.—G. W. von Nawrocki (com.), 3500.

Umbrellas, Parasols, &c.—W. R. Lake (com.), 3209. E. G. Wood, 3304. T. J. Smith (com.), 3312. W. Leggoe, 3520.

Upholstery (Mattresses, Beds, Cushions, Curtains, &c.).—P. Jensen (com.), 3181. W. Clark (com.), 3353. F. Wilson, 3495.

Valves, Taps, Stop Cocks, Plugs; Regulating the Flow and Pressure of Fluids.—H. and W. Sutcliffe, 3199. H. J. Haddan (com.), 3219. C. D. Abel (com.), 3260. J. S. Nickoll, 3303. T. Feather and C. J. Thurlow, 3301. W. Hargreaves and W. Inglis, 3340. J. C. Dennert, 3397. J. Bean, 3411. M. J. Roberts, 3428. G. Massey, 3437. W. Bow, 3473.

Velocipedes.—J. Starley, 3388. W. J. S. Strange, 3408. E. Pink, 3448. G. Walker, 3502. J. H. Hughes, 3531.

Ventilation; Supplying and Purifying Air for Buidings, Mines, Ships, Carriages, &c.—W. H. Dupré, 3202. T. Jewell, 3254. R. Birnbaum, 3362. W. J. S. Strange, 3408. H. P. Holt, 3465.

Vices, Floor Dogs, or Cramps, Cramp Keys, Wrenches, Spanners, and Screw Keys.—H. J. Haddan (com.), 3459.

Voting, &c.—P. Auld, 3255.

Washing, Cleansing, and Wringing Fabrics, Yarns, and Materials.—N. O. Craig, 3188. J. T. Grindrod, 3198. S. Entwistle, 3325. J. Collins, 3427.

Watering, Supplying and Distributing Water, &c.—W. Mathen, 3189. A. le Grand and R. Sutcliffe, 3236. F. Wirth (com.), 3539.

Waterproofing, &c.—B. Birnbaum, 3362. W. Jolley and T. Hargreaves, 3435.

Waterwheels and Engines, &c.—J. C. Dennert, 3397.

Wearing Apparel for Gentlemen, Military Outfits, &c.—G. A. Kino (com.), 3265. B. Birnbaum, 3362.

Weaving, Braiding, Plaiting, Preparing for Weaving.—A. Pemberton, 3234. J. H. Johnson (com.), 3245. T. Eddison, 3298. J. Holding, 3324. J. Marsden, 3405. W. R. Lake (com.), 3414. H. Conradi (com.), 3485. A. M. Clark (com.), 3532.

Wheels for Carriages, &c.—H. E. Brown, 3314. F. Wirth (com.), 3316.

Wheels for Machinery.—T. Sondron, 3527.

Winding, Reeling, and Balling Yarn and Thread.—J. Warwick, 3286.

Window Blinds, &c.—P. Jensen (com.), 3181. A. E. Wemple, 3431.

Windows and Sashes, &c.—J. Johnson, 3542.

Wire-Working, Wire Ropes, Telegraph Cables.—W. R. Lake (com.), 3210. J. H. Johnson (com), 3245. W. Mc. I. Cranston (com.), 3269. W. R. Lake (com.), 3344.

Wood and Veneers, &c.—S. T. Rawlings, 3390. E. de Pass (com.), 3514.

⁂ *The above List is prepared from the Patent Records by Mr. T. Morgan, Secretary of the Inventors' Patentright Association, Limited.*

Mr. Kennedy, the Scottish vocalist, is now giving his entertainment on the Songs of Scotland at the St. James' Hall. All who take an interest in Scottish music may obtain a pleasant evening's amusement by attending them.

Reviews.

TROPICAL AGRICULTUBE.

Tropical Agriculture: a Treatise on the Culture, Preparation, Commerce, and Consumption of the Principal Products of the Vegetable Kingdom. By P. L. SIMMONDS. (Spon.)

We have in this work a mass of information compiled from consuls' reports and other official sources, relating to some of the principal plants cultivated for food and economic purposes generally. In fact, it is a cyclopædia of information relating to certain "commercial products of the vegetable kingdom," and is an expansion of a similar volume published under that title by the same author a quarter of a century ago. Mr. Simmonds brings his information up to time present. A good table of contents and a full index complete the volume, which, although it does not fully justify its title, will form an indispensable reference-book for those who are interested in the commercial products derived from plants.

LOCOMOTIVE ENGINE DRIVING.

"Locomotive Engine Driving: a Practical Manual for Engineers in Charge of Locomotive Engines." By Michael Reynolds. (Crosby Lockwood & Co.)

MR. REYNOLDS, early in this book, gives a description of, and account as to the proper management of the locomotive, which is full of that sound experience such as is to be acquired only on the engine. Chapter I. gives a general description of the locomotive engine and its details, same being illustrated by wood-cuts. Chapter II. discusses the general conditions of good working engines, and calls attention to the fact that "no two sister engines were ever built that would steam and run alike." The five following chapters describe how to set the slide valves, how to become a model engine-driver, what are the duties of the engine-driver, what are the duties and training of a fireman, and what are the duties involved in the management of a train. A chapter on the cause of failures, and one on the work of the "shedday," conclude this admirable practical treatise for the guidance of the locomotive engineer.

Part II. discusses scientific principles, and sets forth the author's views as to the adoption of a system of certificates for drivers and firemen. He considers that the granting of certificates would tend to elevate the position of an honest, trustworthy, and hard-working body of men; that certificates would supply the men with a stimulus to exertion; that they would enable the best men to come to the front; and that the elevation of the class thus ensured would prove serviceable, not only to the men themselves, but to their employers, and, in many respects, to the public.

Mr. Reynolds is of opinion that every driver, before he is permitted to take charge of the regulator, should have served as fireman on goods and passenger engines for a mileage of not less than 150,000 miles. The examination for the certificate should include reading, writing, knowledge of signals, examination of engines, firing, oiling, testing of valves and pistons, and various modes of uncoupling engines when they fail with a train. After running 100,000 miles with this, the third-class certificate, the driver to go up for a second examination, on a printed list of subjects, including the steam engine and boiler in general, combustion, steam, and the theory of expansion. After 50,000 miles' work with a second-class certificate, the driver to go up for the final, or first-class, examination. This is to include the preparation of a diagram illustrating the running of an engine; drawing of elementary forms; working drawings of details of machinery to scale; arithmetic as far as mensuration; mechanics, to explain the safety valve; hydraulics, to explain the pump; pneumatics; chemistry, to explain combustion and the effects of heat, composition of coal, and composition of water. This proposal is followed by specimens of proposed examination matter; tables of the consumption of fuel, of the force of the wind, and other *desiderata;* and code of regulations for enginemen and firemen.

As a work of practical utility this book cannot be too highly praised; but we think Mr. Reynold's scheme requires very careful consideration before any attempt be made to realize it.

STRAIGHT LINES.

"How to Draw a Straight Line:" a Lecture on Linkages. By A. B. KEMPE, B.A. (Macmillan & Co.)

ONE of the very few demands which Euclid makes on what the non-mathematical world regards as common sense is to postulate that it is possible to draw a straight line in a required direction. Mr. Kempe "considers that, although we have an easy and accurate method of describing a circle, we have, at first sight, no corresponding means of describing a straight line." In this we cannot fully agree with him, nevertheless, his little book will be found to contain much instruction.

PHYSIOGRAPHY AND PHYSICAL GEOGRAPHY.

"Physiography and Physical Geography." By REV. ALEX. MACKAY, LL.D., F.R.G.S., &c. William Blackwood and Sons, Edinburgh and London, 1877.

THIS little work is issued to meet the recent instructions from the Science and Art Department. According to the preface the book is intended to cover the conditions laid down by "My Lord," as to examination of students who take up with this branch, or rather branches, of the Science directory.

We are inclined to ask how in less than 150 pages mathematical geography, the atmosphere climate, electricity and magnetism, biology, geology, optical instruments, astronomy, with special reference to our earth, can be properly discussed.

Physical Geography we can understand, but we fail to see the reason of its being struck out from the Science Directory in preference to the subject given in the title which as stated involves a considerable area.

The work before us may in itself be of advantage to those who intend securing the certificates; but the summary manner in which the various portions are discussed will fail, we think, to be of any service to those desirous of making real progress.

ELEMENTS OF CHEMISTRY.

"Elements of Chemistry." Theoretrical and Practical. By W. A. MILLER, M.D., D.C.D., LL.D., late Professor of Chemistry in King's College, London. Revised by Herbert McLeod, F.C.S., Professor of Experimental Science, Royal Indian Engineering College, Cooper's Hill. Part I. Chemical Physics. London: Longman, Green, Reader, and Dyer. 1877.

IN such a well-known text book as this it is only necessary for us to state the various additions and improvements made since the last edition was issued.

This is the first volume of the sixth edition of this excellent work. As stated by Mr. McLeod, in the present edition, recent discoveries in those branches of physics related to chemistry have been incorporated, and several new paragraphs introduced, especially in the section on Polarization of Light.

An attempt has been made to bring the terminology into accord with the views of the present time. Various other improvements have been made, and the editor acknowledges the valuable assistance of Mr. A. G. Greenhill and Dr. Andrews.

We cordially recommend this edition of a standard work to all desiring information relative to Chemical Physics.

ON AMENDMENT OF THE PATENT LAWS, REFERRING TO SEVERAL POINTS NOT HITHERTO DISCUSSED.

By THOMAS MORGAN, A.S.E., &c.,
and Member of the Council of the Inventors' Institute.

AT the present time, probably, the Patent Law question has almost come to be considered as worn threadbare, for certainly almost every aspect in which it can be presented has already been placed before the public by persons who were quite able to deal with the matter. It is, however, now, even more than ever, a question of vital importance to our national prosperity, for viewing matters from what standpoint we will, if we are candid, we cannot well avoid admitting that the industrial supremacy of this country is not at the present moment so unquestioned as it was some years ago.

Various reasons have been assigned for this—some of them of a very cogent character—but for my part I cannot help thinking that the defects of our patent system have as much to do with the matter as any cause that can be assigned, for the object of the patent system being to foster industrial improvements, it will, I assume, be readily acknowledged that if the nature and character of that system should turn out to be of no very fostering character to invention, it must necessarily fail in effecting what was desired to be effected by it. That at present it does so fail may be said to be notorious.

Proceeding with his introductory remarks Mr. Morgan referred to the fact that inventors are in many, if not most, cases poor men,— workmen and others who cannot raise the five pounds', fifty pounds', and hundred pounds', Government payments at present demanded in the United Kingdom, and this throws them into the power of speculators who too often pillage them, from which results a general distrust of the whole system, and a loss to the country by the non-prosecution of many inventive ideas. He here stated that inventions may be divided into the major and the minor inventions (or inventions of detail).

Now these inventions of detail, he remarks, were many years ago attempted to be provided for to a great extent by what is termed the Utility of Designs Act (which is really, although not technically, a branch of the Patent Law; for many things have been attempted to be protected under that Act which might have been patented; and it is clear that when the Act was first passed it was thought they could be so protected); but the decisions of the Courts of Law have shown that not only is shape or configuration—apart from principle—all that can be protected under the Act, but as in the case of Regina *v.* Bessell, Hodges *v.* Driver, and other cases, the improvement of the thing registered must be actually involved in the shape or configuration of the article registered. This seems rather an astute reading of the Act, since the Act speaks of designs for the shape or configuration of any article of manufacture *having reference* to some purpose of utility, which might well be read as meaning simply that the design is simply to have reference to a purpose of utility and *not to ornament* the object evidently being to provide that the Act was to apply to utility designs, since ornamental designs had been provided for by an Act of Parliament which preceded the Utility Designs Act, many of the provisions of which were made applicable to the latter. Assuming that it is desirable to have two distinct forms of protection for property in invention, *the adoption of the one or the other to be entirely at the election of the inventor;* Mr. Morgan suggests:—1st. That the *Provisional Registration* under the Designs Act (for twelve months), which at present costs ten shillings, be reduced to five shillings, with the right of proceeding to complete registration under the Designs Act, or to application for a patent, at the option of the registree.

The *complete registration* not to cost more than *five* pounds, and instead of *three* years, the term of complete registration of the design to be for *five* years, the same as the highest class in ornamental designs, also the legal dogma above mentioned should be modified so that the registration certificate be made to extend only to shape or configuration, no question being entertained as to whether the particular shape or configuration required is of the essence of the improvement. Several designs for modification of the same thing to be allowed to be registered together at a reduced rate, and, as is done under the Ornamental Designs Act, and is similarly provided as regards trade marks under the Trade Marks Act.

However, if it should be thought undesirable to adopt a system of this kind, and that minor as well as major inventions ought to be brought under the Patent Laws, still, continues Mr. Morgan, the Designs Act ought to be kept inmind in any measure for improving the Patent Laws, for in such case it seems to me very undesirable that the Utility of Designs Act should continue to exist, because, unless that Act is fully recognized as a system of protection for inventions (as indeed it is already in practice) it will be productive of much unnecessary complication. As regards the Patent Laws, propositions for very large amendments have been made by a Committee at Glasgow, presided over by Sir William Thomson; and these amendments are generally in accordance with propositions that have received the assent and advocacy of the Inventor's Institute. On some points, however, and these by no means unimportant ones, many inventors and persons interested in inventions disagree; and it is not too much to say that except in asking for a large reduction of cost and greater protective effect in the grant of Letters Patent, almost every person who takes up with the question differs as to the actual plan to be adopted, and certainly a large number of our manufacturers and legislators seem by no means inclined to accord to inventors such favourable terms as these propositions would give them; and it is from this consideration, and not with a view of in any way opposing such a thorough scheme of amendment as I have just alluded to that I have come before you to propose the following practical arrangements, which might, if thought desirable, be worked alongside the improvements in the Designs Acts before adverted to, and would thereby minimise the amount of change in the law, and yet effect very considerable ameliorations in its operations.

These amendments are, in fact, to a great extent in accordance with the propositions made by the Council of the Society of Arts, recommending abstention from great alterations in the present law, until everything that can be done has been done, for working the law as it at present stands with the *fullest effect*; with, however, the *all-important addendum* that a great reduction in the cost of patents be effected (which, as the last Patent Bill brought into the House of Commons by the present Attorney General proposed to largely reduce the patent stamp duties up to and including the grant or sealing), it would seem, we may hope would be conceded by the legislature.

The further points I have to state do not comprise any radical changes in the present system.

These further propositions, which are, however, not simply emanations from my own mind, but (as is also the case with respect to my former suggestions) are in accord with recommendations made by one who has had many years' experience of the subject—Mr. F. W. CAMPIN, the author of the "Law of Patents for Inventions," in Weale's Series—principally refer to arrangements, whereby, without overstepping the provisions of the present Patent Act, the obtaining of patents fo rpalpably old inventions would be reduced to a minimum.

This important object is usually proposed to be effected by the action of a body of technical examiners, as in America. But without dwelling upon the many objections that have been urged against this (for which anyone has only to refer to the able speech of Mr. Bramwell at the meeting of the British Association, at Glasgow last year), it is sufficient for my present purpose to remark that this would not be within the scope of the present Patent Law. The results all wish to bring about could, however, to a considerable extent, be obtained by a better administration of the library and publication department of the Patent Office, coupled with some arrangements which might be made by Her Majesty's law officers, such as I will hereafter describe.

1st. As regards the library, little is needed, except that on some two or three days a week, it should be open till 9 o'clock in the evening. It would, however, be desirable that two first class officials should be appointed to the library, who should possess sufficient technical knowledge to be able to direct persons searching in the library.

2nd. In regard to the publication department, great practical reforms are needed:—

(*a.*) The most useful of the books published by the Commisioners are the classified abridgment books, on "propelling," "India rubber," &c.; but on many subjects, no such books exist, and generally the last patent mentioned in any book is some fifteen years old.

What is wanted is that such books of abridgments should exist on every subject, and should be kept up to present date, which could be done by issuing yearly, or two-yearly supplements; and after a few years, new editions, with the supplementary matter incorporated. All these abridgment books to be issued at no higher charge than at present—less, if possible.

(*b.*) The publication of Final Specifications ought to be effected with greater celerity. Now, it is sometimes three months and more after the Final Specification is filed, before the printed copies are published. It appears the delay is much greater now than it was in Mr. B. Woodcroft's time.

3rd. In concurrence with the above improvements in the publication system, I would suggest the following arrangements:—

(*a.*) On the completion of the twenty-one days of Notice to Proceed, the applicant to be required to lodge a statutory declaration, that he has made investigation by examining the publications of the Commissioners of Patents, searching their records, and otherwise, and, that notwithstanding such investigation, he still believes himself to be the true and first inventor.

This could be done at the requirement of Her Majesty's law officers, who could, of course, refuse to issue their fiats or warrants unless they had the verification of novelty above referred to presented to them.

All investigation at the stage of petition and provisional protection should be left to the simple voluntary action of the applicant. Indeed, the present action of the Crown law officers at this stage is often in excess of the necessity of the case, since a provisional protection is not a *real* protection at all; it is only a *provisional attestation of priority*, and if the Provisional Specification be insufficient, this is at the peril of the applicant, and at this inchoate stage it is embarrassing to an inventor to give every detail of his invention, and to do so, in many cases, would defeat the professed object of such protection.

(*b.*) After the expiration of Notice to Proceed, Her Majesty's law officer, if not satisfied with the verification of novelty above referred to, or deeming it necessary that a fuller provisional specification should be given, should require same, or a better verification before issuing his fiat or warrant.

(*c.*) The opposition system should be amended by allowing inspection of provisional specifications before the hearing, under such regulations as may be desirable. And the opposition at the Great Seal should be allowed, as under the old law, as an original opposition in all special cases. (Reference to the law officer being adopted where necessary.)

(*d.*) The aid of scientific or legal experts in patent matters should be more resorted to.

(*e.*) And such experts should be utilized as referees in law cases.

(*f.*) Greater facilities for amending bad specifications ought to be afforded (provisional specifications especially). The addition of a proper permanent Commisioner (or Commissioners) to the list of Commissioners of Patents for Inventions would doubtless help the better administration of the Patent Office.

4th. But beyond all this, a large reduction of the cost of patents (for which, of course, a short Act of Parliament would be required), is an essential part of any scheme of Patent Law Amendment, and as these suggestions are intended to be tentative rather than absolute, I would recommend a reduction of at least one half, not only (as in the Attorney General's Bill) on the first stages, but in all stages of the life of a patent.

I think if the above propositions were practically carried out a satisfactory scheme of patent law would eventuate, and all that might be desirable hereafter, such as codification of this branch of the law, could be with confidence left to the action of the Patent Office, the Master of the Rolls (who has already expressed an opinion in favour of a large reduction in the patent stamp duties), and her Majesty's law-officers. In the meantime a great boon would be conferred on inventors by enabling them to obtain patents at much less cost, and of a more effective character.

INDUSTRY AND ART.

(From a Correspondent.)

Two songs published by Messrs. Duff and Stuart deserve praise for their industrial merit in reference to good copy "My Highland Home"—words by J. W. Fraser, and music by a composer coming into favour, Louisa Gray—and "Tripping o'er the Meadows." This is not the Highland Home with which the public has hitherto been acquainted; but though a farewell is allegretto in measure, and the words are very pretty. A good Scotch song without nonsense is a novelty. The second song is perhaps of a superior and more fashionable calibre, instituting a new order of the Dolly Varden or pastoral style. We go on to describe some of the most superior music produced. Messrs. Weekes, of Hanover-st. have six new pieces with handsome covers without being illustrated, deep yellow, light yellow, pink, mauve, rose and light green, with the titles, names, &c., in the most wonderful ornamental characters and forms of lines. They are worth purchasing, if only as copies for ornamental writing. "Gavotte Moderne," par Tours, Erwartung melodie, for the piano, componirt von Ehrenfechter is quite German from its depth; "Sweet Hills of Tyrol" Waltz, by Oliver Cramer; "Bourrée Moderne en la Mineur," by Tours;" "Graziella," a Mazurka, by Laniger; "The Merry Peasant," Fantasia on Schummann's favorite air, by Boyton Smith, may be accounted for critically in another number.

PUDDLING AND REFINING.

At the meeting of the Iron and Steel Institute, the President, C. W. Siemens, Esq., F.R.S., D.C.L., &c., in the chair, Mr. I. Lowthian Bell, M.P., read a paper on the separation of carbon, silicon, sulphur, or phosphorus in the refining and puddling furnance and in the Bessemer conversion. This paper was a continuation of one read by the author on the same subject at the Spring meeting. Mr. Bell's paper was one of considerable length, and displayed great research into the chemical aspect of the question of steel and iron manufacture. After alluding to the defects found in some rails on the North-Eastern Railway, the author observed that himself, one of their own Board of Directors, and some of his colleagues, assisted by the able engineer of the company, Mr. T. E. Harrison, were appointed a committee to consider the best method of remedying the defects. The result arrived at after patient investigation and experiment was that phosphorus, the cause of the evil, could be removed by means of oxide of iron during the process of puddling and refining. Mr. Bell remarked that he did not pretend there was any novelty in the idea that oxide of iron was capable of effecting this object. His plea for occupying the attention of the members of the Institute was the pains he had taken to discover the natural laws which governed the affinity between the metalloids referred to in the title of his paper and iron. The effect of those inquiries had been to prove that, by substituting moderate for the more elevated temperatures used in our forges, phosphorus could be made to change places with carbon in the order in which those two bodies left the iron. Whether this fact would have any value beyond that which accompanies his contribution, however slight, to our knowledge on these subjects remained to be proved. Its practical or, in other words, its commercial importance, Mr. Bell observed, must depend upon the expense of removing impurities from those cheap varieties of pig-iron in which they occur. If the cost of iron so purified exeeded that of the more expensive makes, whose original purity enabled the steel maker to use them without any peliminary treatment, the author's work must end where it commenced. It may be observed that the action between the iron and the oxide is as rapid as regards the silicon and phosphorus, so much so that it appears to be the work of five minutes, or perhaps less, provided that the intimacy of the contact is maintained. The mixture often swells so much that it occupies two or three times its original bulk, and the iron is almost invariably changed from gray to white. So far as the author's observations up to this time enable him to judge, oxide of iron in almost any form seems efficacious. He has employed "Blue Billy," mill and forge cinder, hematite ore, and even Cleveland ironstone, and up to this time he is unable to say which answers best. He is engaged at present, at the request of the North-Eastern Railway directors, in erecting proper apparatus for carrying on the necessary experiments on a practical scale. Upon an elevated platform a small cupola will be placed, in which the cinder or other form of oxide will be melted. From this the fused material will be run into a vessel revolving on its centre, into which the liquid iron direct from the blast furnace will also be introduced. It is expected that in this way a sufficient blending of the two fluids will occur to effect the object. For his revolving vessel Mr. Bell proposes to use one of Messrs. Godfrey and Howson's puddling furnaces. Its construction will enable him to heat the interior expeditiously when required, and thus avoid a cold surface cooling the materials before the necessary change is effected, while the power of inclining the vessel at an angle will permit him to continue the process to a point which must be determined by the extent to which it is wished to remove the carbon. In conclusion, Mr. Bell observed that he hoped at the next meeting to lay before the members of the Institute a more detailed account of the plan he proposed for ridding Cleveland and similar qualities of pig-iron of those constituents the presence of which is a source of difficulty to the iron manufacturer.

At the close of the paper, which was listened to by an appreciative audience, the President proposed a vote of thanks to Mr. Bell, which was warmly accorded.

VISIBLE METAL GROWTH.

Several important and highly interesting papers recording instances of metal growths, observed within very brief periods and under ordinary conditions, were prepared by Mr. T. A. Readwin, F.G.S., M.R.I.A., for the recent meeting of the British Association, for the Advancement of Science; and as they were not all presented to the same section, it may be useful to give the substance of the whole of them in a collected form.

In the first of the papers he refers to some interesting Recent Changes from Normal Conditions of certain minerals containing Copper, Silver, and Gold, which abnormal conditions—wanting a better term—he had distinguished as "metal growths." He refers to 15 interesting specimens in illustration, the changes or growths of which, he said, have taken place whilst in his possession at ordinary temperatures, under ordinary conditions. Some of the growths have occurred in sulphides of iron and silver in normal conditions; others after decomposition of the sulphides. Others in normal calcite and quartz. He started the idea that in quartz and calcite such growths might derive their aggregating particles from metal contained in the "matrix" in a fluid state of infinite rarity; which, as yet, may be imperfectly understood, if not altogether unknown. This idea, in possible connection with latent "electro-motive power" of some kind, he thinks may ultimately be found amongst the causes of such new formations or growths. The specimens show, probably, recent native copper, silver, and argentiferous gold (or electrum) growths; also some singular silver sulphide (argentite and acanthite) growth. He stated that he possessed electrum growths out of galena, blende, mispickel, marcasite, tetrahedrite, tetradymite, and barytes. He observed that he does not think such facts as he produces are at all of unusual occurrence, although, for the most part, unnoticed, owing to the popular idea that mineral substances in their present conditions assumed them in time periods very long anterior to the birth of living mineralogists. He, therefore, brings them forward in the hope that in the future more attention may be given to mineral changes in their relation to time.

Another paper on Recent Gold Pseudomorphs was a very valuable one. In connection with it he alluded to four interesting specimens of auriferous quartz which he himself found in Merionethshire; three of them in 1868, and one in 1863. Upon these when he found them were certain indicated quartz crystals, transparent and colourless. All of them, he said, had since become changed to brilliant yellow colour, and were quite opaque; in fact, had become veritable gold crystals—pseudomorphous after quartz, the changes being what are called alteration pseudomorphs, by the addition of a substance which he suggested must have been of the nature of a fluid holding gold in solution in some state, as yet not generally known, if known at all. Such fluid he thought likely to have been pumped up into the crystals from the quartz matrix by capillary attraction. The author brought the subject before the section as one requiring explanation from chemists as to the condition necessary for the production of such pseudomorphs.

The other paper described some Recent Changes in Gold Surfaces, and was illustrated by some specimens of argentiferous gold (electrum containing about 20 per cent. of silver) part of portions taken for assay in 1864 and 1867 from larger bulks, which had been extracted from Merionethshire quartz by amalgamation with quicksilver; the quartz was associated occasionally with copper, lead, zinc, and iron sulphides. When the assays were made the corresponding portions under notice presented the usual appearance of smoothness. A few months ago Mr. Readwin observed marked alterations on the surfaces of the nature of striation, particularly in the specimen 276, and he stated that within the last month the striæ had become much more distinctly pronounced, and therefore, he thought of greater interest. These changes he brought to the notice of the British Association as facts which appeared not to have been generally observed.

FOREIGN SCIENCE.

M. Mekarski has, it appears, invented a self-moving carriage with compressed air, for tramways, about which a very interesting discussion took place in the Society of French Engineers. His invention demands the heating of the air compressed at the time of introducing it into the moving cylinder, and mixing with a certain quantity of steam at high temperature. It is possible to detain the air usefully as well as the steam itself, in preventing the considerable coolness, which has then a tendency to be produced, the sum of work furnished by a like quantity of air is noticeably augmented.

The Swiss Society of Natural Sciences, held at Bex, Canton de Vaud its sixteenth session, on 20th August, the following were the sections: Geology, Zoology and Botany, Medicine, Physics, and chemistry. It is to be held at Berne next year. None of the papers read were of interest to inventors. In the French Academy of Sciences M. Rayosand maintains that he has the priority over M. Moncel in discovering the conditions of the maximum indication of galvanometers. M. du Moncel persists in believing that this claim is not founded. A rather interesting note was forwarded by M. Livache, on researches into the nature of the gases contained in the tissues of fruits. If a very healthy fruit were studied, the gases contained in its tissues would be found as a mixture of azote and oxygen, in the proportions in which they are found in in atmospheric air. If the tissues have just been torn a simple combustion is produced immediately, the oxygen being rapidly transformed into carbonic acid. In fine, if the fruit thus torn be abandoned to itself, a veritable fermentation is established in the bosom of the pulp identical with the intercellular fermentation described by MM. Lechartier and Bellamy, and there is produced an abundant discharge of carbonic acid, whilst the azote undergoes no modification. A new steam apparatus for cutting fire wood has been produced in France; the drawing resembles the shooting handcarts you see at races and fairs, or a magnified knife grinder's apparatus. Referring to wood, the Turner's Manual, recently established in Covent Garden, (an English edition from the French of Bergeron), gives some beautifully painted illustrations of woods of all kinds.

M. Marie Davy says, in a report to the Municipal Council that the scientific establishment of Montsouris will certainly be one of the places of attraction for foreign savants. There is placed an Astronomical Observatory directed by the Bureau of Longitudes, including a school of practical *géodésie* and topography confided to

Commandant Perrier, it is probable there will be an early addition of a school for scientific missions.

The Prefect of the Seine has just named a special commission composed of engineers cultivators, and industrialists, to study from an agricultural point of view the question of the employment of waters in the three quarters Island of Gennevilliers. This commission will present a report on the advantages and inconveniences which this system of irrigation will present from a hygienic point of view. There are some technical matters in this country for the settlement of which commissions of scientific men, industrialists, inventors and manufacturers should be more frequently employed. It occurs to us to mention in reference to Mr. Mason's method of warming railway carriages by steam escape from the engine, that he must have read one of our articles under the above heading at the beginning of the year in which an almost similar invention is described, not but that we shall be thoroughly happy if the publication of these articles leads to improvements and inventions which otherwise would not have been thought of.

In each of a quantity of the late numbers of *Les Mondes*, there has been a long note on the project of establishing an interior sea in Algeria. No doubt such an undertaking would open up employment of skilled and general labour, but there are grave doubts as to its feasibility.

TRADE-MARKS IN GERMANY.

A JUDGMENT of great importance to the mercantile community of this country has been pronounced by the Imperial Court of Germany, at Leipsic, in favour of Messrs. J. and R. Tennent, of Well-park Brewery, Glasgow, and Riches-court, London, plaintiffs, against Messrs. Deetjen and Schröder, brewers, Hamburg, defendants. The plaintiffs brought a similar action—for piracy of their trade-mark—against the defendants in 1864, when, however, owing to the state of the law of Germany at that time, they were practically unsuccessful; and for the past 13 years Messrs. Deetjen and Schröder have been using an exact *fac simile* of the trade-mark of Messrs. Tennent, whose only protection has been that the defendants were not allowed to use their signature. Until last year manufacturers in this country unfortunately had no protection for their trade-marks in Germany, where they have been pirated in most trades to a large extent. The present case has been before three of the courts. The Tribunal of Commerce of Hamburg, the first court before which the case was heard, pronounced an elaborate judgment on the 19th of June, 1876, in favour of Messrs. Tennent, but this judgment was reversed by the Supreme Court on the 1st of December last. It was then feared that the new German Trade-Marks' Act would be ineffective in protecting the manufacturers of this country, but fortunately those fears have been set at rest by the judgment of the Imperial Court of Leipsic. The judgment is to the effect that as goods bearing trade-marks, after they have been distributed by commercial trade, and have been, in part, taken to circles far distant from the place where they were produced, can be quickly and easily recognized in the retail trade and by consumers. It is self-evident that the general appearance of the trade-mark is taken into consideration, and that thereby insignificant deviations—as, for example, such as are only caused by single marks added to the figures used—according to the circumstances, are of little or no consequence. The names of firms which might be used in the grouping of trade-marks have no significance, but stand in the same position as numbers, letters, or words used with the figures. It was, therefore, in the judgment of the court, only a question between the parties whether the defendants, according to Section 9 of the Law of 1875 were entitled to a right in competition with the plaintiffs to the use of the trade-mark in question, for this reason, because that mark was, until the commencement of the year 1875, generally acknowledged in the trade as the mark of the defendants' manufacture. That question is, in agreement with the Commercial Tribunal, to be answered in the negative. As is shown by the papers of the action brought before the lower court in the years 1863 and 1864, between plaintiffs and defendants, the defendants did not then sell the beer produced by them under the trade-mark in question as their beer, but as that of the plaintiffs. They went so far as to imitate the trade-mark and labels of the plaintiffs in all their parts, even making use of their full name, as also the name of the plaintiffs' brewery, completely and exactly. They certainly had to give up the use of the name of the plaintiffs' firm in consequence of the judgment given against them, but could not then be compelled to do more. They thereupon continued to sell their produce, retaining the trade-mark of the plaintiffs and leaving out the name of the plaintiffs' firm. By virtue of these and other considerations, the decision of the High Court was ordered to be annulled, and the decision of the Tribunal of Commerce, reinstated, and compensation of the costs of the second and third instance was affirmed.

REPORT OF THE COUNCIL OF THE BRITISH ASSOCIATION FOR THE YEAR 1876-77.

PRESENTED to the General Committee at Plymouth, on Wednesday, August 15th, 1877.—The Council have received reports during the past year from the General Treasurer, and his account for the year will be laid before the General Committee this day. The following resolution was referred by the General Committee at Glasgow to the Council for consideration, and for action, if it should seem desirable:—"That the Council be requested to consider and take steps, if they think it desirable, to urge upon Her Majesty's Government the advisablity of forming a Museum of Scientific Instruments and Chemical Products, as suggested in the Memorial presented in June last to the Lord President of Her Majesty's Council." The Council having considered this resolution, came to the conclusion that while they believe that a Permanent Museum of Scientific Instruments might be of great value it is their opinion that the objects of the Memorial referred to in the Resolution submitted to the Council are, as a whole, neither so clearly defined, nor so free from valid objections, as to justify the Council of the British Association in supporting the proposals of the Memorial in its present form.

The attention of the Council having been drawn to the character of some of the sectional proceedings at late meetings of the Association, a Committee was appointed to consider and report to the Council on the possibility of excluding unscientific or otherwise unsuitable papers and discussions from the sectional proceedings of the Association. The Committee recommended that, in the rules for conducting the business of the Sectional Committees, the following rules should be inserted, viz.:—1. The President shall call on the Secretary to read the minutes of the previous meeting of the Committee. 2. No paper shall be read until it has been formally accepted by the Committee of the Section, and entered on the minutes accordingly. The Council propose that this alteration of rules shall be carried into effect. The Committee in their report further considered that some of the subjects brought before Section F could not be considered scientific in the ordinary sense of that word, and that the question of the discontinuace of Section F deserved the serious consideration of the Council. The Council have requested the Committee to report more fully the reasons which had induced them to come to this conclusion, but the Committee have not yet made a further report. The Council regret to state that Mr. Griffith has informed them that he is desirous of withdrawing from the office of Assistant General Secretary, which he has held for nearly sixteen years. The Council having carefully considered the steps expedient to be taken in consequence of Mr. Griffith's proposed withdrawal, have resolved to select Mr. J. E. H. Gordon, B.A., of Caius College, Cambridge, for nomination as Assistant Secretary after the Dublin Meeting in 1878. The Council propose that Mr. Gordon be requested to attend the present Meeting and to assist generally during the ensuing year. To cover his expenses during this preliminary period, the Council recommend that a grant of £100 be made to him.

The following foreign men of science who had attended the Glasgow meeting have been elected Corresponding Members:—Professor Cremona, Professor Eccker, Dr. B. A. Gould, Professor Häckel, Professor Von Quintus Icilius, Dr. G. Jung, Dr. Lasaulx, Professor R. D. Silva, Baron Von Wrangell, Professor Wüllner, Dr. W. J. Janssen.

The Council have been informed that invitations for the meeting in 1879 or following years will be presented from Swansea and Nottingham, and from York for the year 1881, being the 50th anniversary of the British Association, the first meeting of which was held in that city.

The following are the names of Members of Council for the past year, who, in accordance with the regulations, are not eligible for re-election this year, viz.:—Sir Rutherford Alcock, Professor Flower, Mr. Gassiot, Mr. Merrifield, Mr. Gwyn Jeffreys.

The council recommended the re-election of the other ordinary Members of Council, with the addition of the gentlemen whose names are distinguished by an asterisk in the following list:—F. A. Abel, Esq., F.R.S.; *W. H. Barlow, Esq., F.R.S.; F. J. Bramwell, Esq., C.E., F.R.S.; Professor Cayley, F.R.S.; Warren De La Rue, Esq., D.C.L., F.R.S.; J. Evans, Esq., F.R.S; Dr. W. Farr, F.R.S.; *Professor Foster, G.C., F.R.S.; W. Froude, Esq., F.R.S.; *Lieut.-Colonel J. Grant, C.B., F.R.S.; J. Heywood, Esq., F.R.S.; Lord Houghton, F.R.S.; W. Huggins, Esq., F.R.S.; Professor Maskelyne, N.S., M.A., F.R.S.; Professor J. Clerk Maxwell, F.R.S.; Professor A. Newton, F.R.S.; Admiral Sir E. Ommanney, C.B., F.R.S; W. Pengelly, Esq., F.R.S.; Professor J. Prestwich, F.R.S.; Professor G. Rolleston, M.A., F.R.S.; Professor H. E. Roscoe, Ph.D., F.R.S.; Dr. W. J. Russell, F.R.S.; *Professor Burdon Sanderson, F.R.S.; Professor H. J. S. Smith, F.R.S.; *Warington W Smyth, Esq., F.R.S.

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President, SIR ANTONIO BRADY.

Proceedings of the Institute.

The Institute being still out of Session, there is no business to report. During September the Executive Council will meet to make preparations for the Session 1877-78 early in October.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.
F. W. CAMPIN, Sec.

N.B.—The movement for the REDUCTION OF PATENT STAMP DUTIES *is still on foot; those who wish to support it should at once communicate with the Secretary.*

MEMBERS OF THE INSTITUTE ADMITTED SINCE LAST PUBLICATION.

Messrs. H. C. Ahrbecker, S. Alley, J. Agate, S. Andrews, C. Burgess, H. G. Barrey, P. C. Bunn, H. F. S. Branduer, F. Bullock, A. C. Bagot, J. Brewster, F. Barnes, J. A. Cooper, Sir Arthur Cotton, K.C.S.I., F. Cutlan, Capt. T. Clarke, W. Carter, G. G. Davidson, P. W. Davis, G. Drevar, G. A. Davenport, S. T. Dutton, G. Evans, S. S. Eston, J. Francis, J. Foster, H. Faulder, G. Green, E. Gittins, C. S. Gordan, R. W. S. Griffith, W. Holyoake, J. Hartley, C. P. Harding, R. Henderson, T. F. Harvey, N. Jochumson, J. Jopling, C. T. Kingzett, G. B. Knott, H. Lee, A. LeGrand, J. Lewtas, I. H. Lovel, F. H. Larmouth, I. Mawson, I. D. Macdonald, MD., F.R.S. &c., I. S. A. Menier, D. McMechan, I. Morrison, G. Nurse, G. Newson, R. S. Oakeshott, Perez de la Sala Pastor, O. Packer, G. E. Pritchett, T. Powell, C. Robey, J. Russell, J. Robson J. Roberts, G. R. Stevenson, J. Strong, G. Stavers, H. Sharp, J. Sample, W. Sanday, J. E. Stone, A. P. Turner, J. H. Tarrant, B. Templar, J. B. Thompson, T. Temple, W. Tatson, J. Vernon, W. White, F.S.A., C. Woodall, T. J. Waters, C. H. Wetzell, Professor I. A. Wanklyn, T. Whitwell, M. Zingler.

Monthly Notices.

Prof. A. Oppenheim, a well-known German chemist, died on Monday last at Hastings. His wife, who had come with the deceased to this watering-place for the benefit of her health, expired on Monday morning. Immediately upon her death, Prof. Oppenheim locked himself up with the body, and was soon afterwards found lifeless on the sofa. A post-mortem examination showed that death had been caused by prussic acid. Prof. Oppenheim, who had only recently been appointed to the chair of chemistry in the Academy at Münster, Westphalia, was distinguished by his researches in organic chemistry. His loss will be felt equally by his fellow-workers and personal friends. —*Athenæum.*

Davyum, the last addition to the list of new elements, is stated by Sergius Kern, its discoverer, to be specific gravity at 25° C. 9·385, and from preliminary investigations, he concludes its atomic weight to be near 154, not, as first supposed, 100.

Messrs. Smith, Elder, & Co. have the following medical works in preparation: "Goulstonian Lectures on the Natural History of Pulmonary Consumption," by Dr. A. B. Shepherd, —"Spinal Disease and Spinal Curvature: their Treatment by Suspension, and the Use of Plaster of Paris Bandage," by Dr. L. A Sayre,—"The Examiner in Anatomy, a Course of Instruction on the Method of Answering Anatomical Questions," by Mr. A. Trehern Norton, F.R.C.S.,—"Diseases of the Nervous System: their Prevalence and Pathology," by Dr. Julius Althaus,—and "On Chorea and Whooping Cough," by Dr. Octavius Sturges.

The Royal Exhibition to the School of Mines of £50 per annum for three years has been gained by Mr. J. J. Beringer, of Redruth, one of the pupils of the Miners' Association of Cornwall.

The Geological Record for 1875, edited by Mr. William Whitaker, F.G.S., has just been issued. This, the second volume of "an account of works on geology, mineralogy, and palæontology published during the year," is a considerable improvment on the *Record* issued last year. By sundry new arrangements reference is rendered more easy, and the addition of an index of new species greatly increases the value of the book to the palæontogists.

The Annual Meeting of German philologists and teachers, (36th), will take place at Wiesbaden, from September the 26th to the 29th.

The Dublin University Magazine, which is taking a very high place amongst our serials will, it is stated, in the October number, contain a sketch of Roumanian history by a late resident at Bucharest, and a continuation of the account of the early life of the late Mortimer Collins, who five-and-twenty years ago was a constant contributor to the magazine. Mr. Conder contributes a paper on heraldry.

M. l'Abbé Martin has been lately collating the MSS. of Barhebraeus's Grammar to be found in the British Museum and the Bodleian Library with his copy made from the Paris MS. We may accordingly expect a critical edition of the most important Syrian Grammar ever made by a native.

Mr. Charles Mackeson will contribute to the *Companion to the British Almanac* for 1878 (of which he is the editor) an article on "The Working of the School Board System." This paper will form the complement of Mr. Mackeson's article in the *Companion to the Almanac* for 1876 on "Primary Education in England and Wales," in which he traced the growth of the national system of education from its beginning in 1808, when the British and Foreign School Society was established, down to the passing of the Act of 1870, by which the School Board was created.

The concluding volumes of the first series of the French "*Archives Parlementaires*" will shortly be published. They bring the "French Hansard" down to 1799, and have, therefore, got through the most difficult portion of the task, the *Moniteur* henceforward affording an official and thoroughly trustworthy record. The "Archives" are published under the superintendence of M.M. J. Mavidal, C. Laurent, and E. Clavel.

The British Museum.—The removal of the Lycian marbles from the old gallery in the British Museum to the newly-finished extension of the hall towards the Reading Room is being rapidly carried out. The new room over this extension is fast approaching completion, and preparations are making for the transfer of the cases and portion of the Christy Collection of ethnographical objects from the Museum in Victoria-street.—*Athenæum.*

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A RECORD OF PROGRESS IN
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OCTOBER 1, 1877.

LEVERRIER.

Amongst scientific workers Astronomers must be awarded a place of high eminence; for there is no science, not excepting even chemistry, that can show a clearer title to be so termed than astronomy. Pure mathematics may by some be accorded the precedence, but even if this be admitted it will by no means depreciate the position of the votaries of this science, seeing that an astronomer is a mathematician and something more, as he requires to be not only an exact scientific calculator, but also a careful, not to say incessant, observatory worker.

Independently of the high qualifications of workers in this science, one cannot lose sight of the advantages the pursuit of it offers to us all. It has been said,

> "The proper study for mankind is man."

But who that looks up to the starry sky on a fine evening can fail to catch the spirit of the Psalmist, and "consider the Heavens," with a feeling of awe and admiration, accompanied with a grateful sense of having before him a field for the employment of his energies of an elevating and interesting character; it is a pursuit, moreover, which can be adopted to a moderate extent without moving out of the parlour or the study, and is yet an occupation so far from being improper for mankind, as that by the aid of astronomy the navigation of the ocean has become a matter as easy, and considering all things, possibly as safe, as a long journey landward.

Viewing the subject in this way, we feel that the decease of a great astronomer is an event that should receive prominent notice in the SCIENTIFIC REVIEW, and hence the demise of M. LEVERRIER, who expired in Paris on Sunday, 23rd ult., is worthy of the place in our columns which we now accord it. Without for one moment losing sight of the importance of the labours of Laplace, Arago, Mrs. Somerville, the Herschells, Airy and Adams, we may yet use the present moment as an occasion for panegyric on the life and labours of this great *savant*.

The name of Leverrier immediately calls to mind another name, that of our own countryman, ADAMS, for the great event in the life of the former also pertains to that of the latter, we refer of course to the discovery of the planet Neptune, for we quite agree with the statement of a contemporary that the English and French rivals worked, without each other's knowledge and without comparing notes, upon the solution of what even to cognate minds appeared to be a hopeless mystery. The infinity of distance at which the missing planet is removed from our earth, and the extremely abstruse, difficult, and elaborate nature of the mathematical calculations necessary for ascertaining its magnitude and fixing its locality, presaged that all the toil of these indefatigable men might, as has often before been the case with scientific investigations, be but labour lost. To fix the tabular places of the planets by calculations based on the analysis of Laplace, was, in short, the stupendous work which Leverrier and Adams took in hand; nor is it possible to feel any other emotion than joy and gratitude when it is recorded that light was simultaneously revealed to the Englishman and the Frenchman alike. Upon the 29th of July, 1846, the equatorial of the Cambridge University was first pointed by Professor Adams to that spot in the heavens where his calculations told him that Neptune would be found, and in the following September the planet was, in astronomical phrase, "grappled" by the collossal telescope. Upon the 31st of August in the same year Leverrier addressed a letter to the astronomers of Berlin, giving them the result of his researches, and upon the 23rd of September, within one degree of the spot assigned to it by Adams, the missing stranger was found. It is pleasant to record that no jealousy was evinced, no claim to priority of discovery set up, by either of these successful and distinguished men. Each had fairly worked out the problem of which his own ingenuity had shown him the inevitable necessity, and either of them might have fairly exclaimed "Vixi" upon the evening of the day when the telescope proclaimed to him that Neptune had been discovered.

In one aspect the life of Leverrier points the moral that a man's works are often greater than himself. For this eminent Frenchman was the greater part of his life infected by Anglophobia, and like M. Arago, could, as a politician, unreservedly give way to prejudice and passion in regard to England and its constitutional monarchy. For although it was the delight of our Royal Society and our Royal Astronomical Society to load them both with richly merited honours yet, (as our contemporary, the *Daily Telegraph*, in its admirable article goes on to remark), "from their lips came nothing in return but denunciations of England, breathing threatenings and slaughter against her. It is, however, more grateful to us to relate that increasing years brought philosophic wisdom to a mind eminently qualified to receive it, and M. Leverrier learnt before the close to appreciate and even to venerate a country which had never looked upon him otherwise than with gratitude and esteem. There was a time when his hatred of England made him dearer to our kinsmen in the United States; but happily, that time has now passed away, never, we hope, to return. In no part of the world have Leverrier's contributions to stellar knowledge been watched with more interest than in the Great Republic of the West; and the observatories with which the New World is thickly studded, and especially those at Washington and Cincinnati, afford ample evidence that astronomy will not be neglected by a nation which Jefferson, the author of the Declaration of Independence, solemnly dedicated to the pursuit and study of philosophy. The examination of the data upon which the astronomers of Europe and Asia have based their theories of our solar system occupies many of the most aspiring minds in Australia and the United States; nor is it a small incentive to men with a taste for studying the heavens that nowhere do the stars shine with such luminous light as in the Western and Southern Hemispheres. It was notorious that Leverrier was easily accessible to all who sought him at the Imperial Observatory in Paris, and that even those who had nothing but a perfunctory claim to the possession of astronomical science were entertained by him with a welcome which never grew cold. Truly might it be recorded on his tombstone that no previous astronomer could ever point to such a life of successful and completed labour as that of Leverrier."

One point the decease of this great man inevitably presses upon our attention, and it is the difference of position which the scientific and literary men of France occupy, as compared with the status of those of England. In the former country learned men of eminence are recognized as the *equals* of peers and princes; whereas in this country, although there may be a show of equality, it has, in truth and fact, no substantial reality. We hear a great deal about the promotion of education and the dissemination of scientific knowledge; but until men of science and letters obtain a well-acknowledged status of the highest character we shall be without a most important incentive to the advance of knowledge.

BRITISH ASSOCIATION.

Geology.—Section C.—This section met at the Mechanics' Institute, Mr. Pengelly presiding.

Professor A. S. Herschel, M.A., F.R.A.S., read the fourth annnal report (by himself and Mr. G. A. Lebour) on the thermal conductivities of rocks, which pointed out that the work during the past year consisted in the verification of former results, and in the extension of the inquiry to other rocks. The same apparatus was used as before, with the substitution of iridioplatinum for iron. In the wise functions of the thermopile, fluorspar was again found to have the highest conductivity, and sand the lowest of the rocks tried this year. Fluorspar, quartz, and quartzite formed a natural group, with high conductivities. Granites—red and grey from various localities—came next; micaceous sandstone, and mica-schist next; marbles and dolomites following, with all the more compact limestones. Traps came next, then altered shale chalk (white and grey), and firestone, shales, and dry clay, and sand, which was markedly the worse conductor. Clay with a quarter of its weight of water became as good in condition as altered shale, while sand with half of its weight of water became nearly as good as quartzite. Plate-glass had about the same conductivity as dry clay.

Mr. Pengelly and Mr. Sorby called attention to the importance of guarding against the influence of convection currents in studying the conductivity of rocks. Mr. Williams stated that fluorspar differed in different directions as to its power of conducting electricity; and thought that probably the same would occur with respect to thermal conductivity. Mr. D. Burns and Mr. Baldwin Latham also spoke, the latter referring to the temperature in the chalk wells at Croydon. Mr. Lebour pointed out the connection which existed between rock-conductivities and discrepancies found in temperature observations in wet and dry bore-holes; and invited members to co-operate with the committee by sending them specimens of various rocks, sufficiently large to permit of discs, 5in. in diameter, and at least ½in. thick, being cut from them.

The fourth annual report of the Committee on Erratic Blocks, which had been drawn up by the Rev. H. W. Crosskey, was read by Mr. C. J. Woodward.

The next paper was read by Mr. J. Gwyn Jeffreys, LL.D., F.R.S., and the subject was "The Post-Tertiary Fossils procured in the late Arctic Expedition, with Notes on some of the Recent or Living Mollusca from the same Expedition."

Mr. C. E. De Range, F.G.S., read a paper "On the Correlation of certain Post-glacial Deposits in West Lancashire."

Mr. G. H. Morton, F.G.S., read an interesting paper "On the Carboniferous Limestone and Millstone Grit around Llangollen, North Wales."

Secion D.—Biology.—Department of Anatomy and Physiology.—This Department met at eleven o'clock in its room at the Royal Hotel, and was favoured with a large attendance. Professor Macalister presided.

The Rev. Professor Haughton, F.R.S., lectured "On Transcendental Anatomy, or a Geometrical Investigation of the best possible number of Limbs for Terrestial and Aquatic Animals."

The Rev. W. H. Dallinger delivered an exceedingly interesting lecture "On Researches on the Life History of the Simplest Organisms."

Mr. G. T. Bettany read a paper "On the Use of the Terms Assimilation and Metastasis."

Mr. D. J. Cunningham, M.D., gave an illustrated but purely scientic and anatomical discourse upon "The Mammillary and Accessory Processes as Persistent Epiphyses in the Human Spine," which was listened to by not more than five or six members, and upon which a very brief and semi-private conversation ensued.

Section E.—Geography.—Commander Cameron, C.B., on African Exploration.—There was a much larger attendance at this Section in the Saltash-street Schools yesterday, the interest being enhanced by the reading of papers—one by Commander Cameron, C.B.—upon the exploration and utilisation for commerce and settlement of the regions of Central Africa. Vice-Admiral Sir Erasmus Ommanney, K.C.B., again presided, and briefly introduced "that distinguished traveller, Commander Cameron" (whose name was received with warm applause), with a few remarks on the importance of the work in which he had taken so noble a part.

Section F.—Economic Science and Statistics.—The section met at the Friends' Schoolroom, Earl Fortescue presiding. There was a large attendance.

The Population Question was the subject of a paper by Dr. William Farr, F.R.S. It was anti-Malthusian, and excited much controversy.

"The Water Supply of London," formed the subject of a paper by F. J. Bramwell, F.R.S. In the year 1874 the population of London supplied with water was 3,655,000, dwelling in 511,000 houses, and the daily average quantity throughout the year was 116,250,000 gallons. The quantity per head, therefore, for all purposes was a little under 32 gallons. This water supply was in the hands of eight companies, and the aggregate capital employed in 1874, including share and loan capital, was £11,196,000. The gross income from the water was £1,137,000, and, in addition to this, there was £16,000 from land rents, making a total of £1,153,000. The expenses were £447,000, so that the nett income was £705,700, giving a rate of interest upon all capital employed of proximately 6·3 per cent. The last report, made in June, shewed that the population supplied was 3,796,000, dwelling in 533,000 houses, and the average daily quantity was 132½ million gallons, equal to a little less than 35 gallons per head. The water supply of London for purposes of cleanliness (personal and domestic), manufacturing, and road watering was generally satisfactory, but, except in rare cases, this could not be said of the water for drinking and culinary purposes, nor in any case could it be said of the water for the purposes of extinguishing fire. And yet the importance of these two objects it was difficult to exaggerate, as on the quality of the potable water depended to a large extent the health of a vast population, and on an adequate provision for the extinction of fire depended the preservation of the largest aggregation of wealth in the world. There were many who supposed that the defeats complained of arose from the fact of the supply being in the hands of private trading companies, and who urged that if the undertakings of those companies were acquired by the governing body of the metropolis, so as to put the whole water supply under one management, every complaint would disappear, but this could not be the case if, after the acquisition of the property by the governing authority, the present system was continued. That system was the obtaining of water for all purposes either from the Thames, the sea, or from wells. With the exception of the well supply the water so obtained was put into depositing reservoirs, was filtered, and was thus treated, whether it be used to flush a sever, or whether it was drunk and delivered at one and the same pressure, whether it be required at the basement of a house, or for the extinction of a fire. If the governing authority pursued the same system obviously, though there might be some economy in management, there would be no radical change, either in the quality of the water for driuking, or in the quantity and pressure for the extinction of fire. It would be no advantage for the Corporation to buy up the present companies unless they went to the different source for a supply, and his proposal was that the water should be got from deep wells within a distance of about twelve miles from London, and pumping that water to reservoirs 400 feet above the ordnance datum, these reservoirs to be connected or coupled with large mains, and arterial pipes to be laid in every street, and hydrants fixed on the pipes. These pipes for the supply of potable water should be laid to every house, with a close cistern attached, so that from three to ten gallons could be drawn off at a time. But all water for washing purposes was to be taken from the companies as before. The object of this proposed change was to give to the metropolis good water for drinking and culinary purposes, as well as to secure a sufficient quantity for the extinction of fire.

The chief point in the discussion was the importance of all water supply being under the control of the sanitary authority of the district. In the case of London the Metropolitan Board of Works should be the authority.

In this Section Mr. T. Morgan, read his paper on the Patent Laws, which we give in another column. A discussion ensued in which Sir Antonio Brady, Mr. Stephen Bourne and others took part. The general opinion appeared to be that though Mr. Morgan's suggestions were worthy of earnest consideration yet the American System would be generally preferred.

Section G.—Mechanical Science.—This section resumed its sitting in the Courtenay-street school, Mr. Edward Woods, C.E., presiding. The attendance throughout the day was better than it had been on any previous occasion during the meeting.

Professor O. Reynolds presented the report of the committee appointed to consider what effect reversing the screw had on the steering of a steamer under full way. Since the last meeting of the Association the committee had carried out further experiments, and the results now obtained showed that the larger the ship the more important the effect of reversing the screw became. In answer to the request of the committee, the Admiralty had made a trial with H.M.S. *Speedy*, but the conditions under which it was conducted precluded the possibility of more light being thrown on the subject. The greatest speed was five knots, and the effect of the rudder with the screw reversed was so small that the vessel in most instances turned her forward end into the wind. (Laughter.) The Admiralty had been urged to have experiments made with larger and more powerful ships, but as yet had not assented. The committee forwarded copies of their last year's report to the Admiralty, the Board of Trade, the Trinity House, and other corporations, but no intimation had been received as to any action being taken upon it. The report was discussed at the Conference of the Association for the Reform and Codification of the Law of Nations last year at Bremen, where a resolution was agreed to declaring that the existing international rules for preventing collisions at sea were not satisfactory, and it was desirable the Governments of maritime States should take counsel together with a view to amend the rules and adapt them more carefully to the novel exigencies of steam navigation. This shewed that the subject had already attracted considerable attention, and it was important to notice that the conclusions of the committee had not yet in the smallest degree been controverted. Numerous collisions had happened during the year, which, to judge from the law reports, might in many instances have been avoided had the effect of reversing the screw been known and acted upon; but it did not appear as if a consideration of this had influenced any of the judgments given. The collisions had for the most part been with small ships, and so had not come much in notice. The loss of the *Dakota*, however, was a disaster of the first magnitude, and would unquestionably cause the subject to be considered by the authorities.

Reading a paper on the same point, the Professor said the fact that the results which had been established by the committee were so little known to pilots and seamen, besides being likely to excite surprise, would tend to cast a certain amount of discredit, if not on the truth of the results themselves, at least on their importance. It seemed as if nautical men must have formed their opinions from experience, and such was the faith of the English people in the practical that it was very difficult indeed for them to believe that a few landsmen, calling themselves scientific, could teach sailors how to steer ships. So strong was this feeling that it was to collisions they must look in the hope of preventing collisions. (Hear and laughter.) This sounded like a bull, but it was perfectly true, for nothing but disasters would awake our rulers to the idea that something was wrong. (Hear.) Fortunately, or unfortunately, such disasters were not wanting. There were the cases of the *Ville du Havre* and the *Loch Earn*, in which the collisions were undoubtedly due to the steamers having turned in the opposite direction to that intended. These and other disasters furnish evidence enough of the mistakes which had been perpetrated, and of the importance as well as the truth of the results the committee had established. He fancied that the ignorance which existed was due to the fact that few seamen had turned a ship under full way with the screw reversed, and contented themselves by arguing as to what must happen in such a case from their experience in manœuvring their ships when moving slowly. Of such manœuvres they have had abundance, but as soon as they got beyond their experience, they adopted the seemingly obvious, but entirely erroneous opinion that the way of the ship would cause the rudder to act as if she was going ahead in spite of the screw being reversed. He felt strongly that in speaking thus in a town like Plymouth he ran the risk of being looked upon as impertinent. If he were wrong he was impertinent, and no one would feel it more than he should. It was not a pleasant task to point out imperfections, however accidental they might be. Even if one saw the wheel coming off an omnibus, all the thanks he was likely to get for pointing it out to the conductor was to be asked if he could not tell him something he didn't know. (Laughter.) Of course, they must learn as they went on, and all he, with deference, asked of seamen was to try the experiments for themselves, and then aid the committee in bringing facts under the notice of the Legislature. (Applause.) Their own interests demanded this, for as things now were great injustice might be done to the captain who in a case of emergency adopted the very best course to save his ship.

Mr. William Froude thought the question which Professor Reynolds had so ably dealt with of immense importance, and deserving minute consideration. Having himself had some experience of small steam launches, he had been surprised at the effect produced by the working of the screw, so that he concurred with the conclusion of which Professor Reynolds individually, and the committee collectively, had arrived. If sailors would occasionally listen to the advice of outsiders, it would do them no harm. Ignorance as to the effect of reversing the screw upon the way of a ship would often lead a captain into danger which might be avoided. (Hear.)

Mr. J. R. Napier agreed with Mr. Froude as to the importance of the subject, and considered it absolutely essential that further trials should be made in order to ascertain whether a little more experience would absolutely corroborate the more than theories of the committee. (Hear.) The experiments ought to be carried out under the auspices of the Government,—not of that designated the Board of Trade, which consisted of one Thomas Gray, to whose judgment on such points he attached very little value. (Laughter.)

Sir William Thomson urged that the committee should be reappointed, so that the Admiralty might have another opportunity of confirming or refuting the conclusions. This was undoubtedly nothing less than a national question, for the conflict now going on between Russia and Turkey proved that skill in manœuvring was of vital importance in torpedo warfare. In olden times the glory of England was maintained by the facility with which her ships were manœuvred, our navy being a match against the navies of all the world in this respect, and he hoped nothing would occur to destroy that pre-eminence.

Mr. J. Mactear inquired what effect reversing the screw would have in the case of a twin-screw vessel.

Professor Reynolds stated that the committee had not yet had an opportunity of making experiments with twin screws.

The President hoped the entire question would receive the consideration it deserved, both from the Admirals and the private shipowners of the country, it being surprising that so much ignorance prevailed among captains as to the manner in which vessels could be manœuvred.

The committee having been re-appointed, the subject dropped.

Mr. William Froude, F.R.S., next read a highly scientific, but most interesting paper, the object of which was to show the effect produced on the resistance to a ship's motion by the lengthening or shortening of the flat middle body between the bow and stern. The results were based upon experiments made at Chelstow Cross with model having the same ends, but different lengths of parallel both inserted amidships. By separating the effect of the fractional skin resistance, which was proportional to the wetted surface, he proved that the increase or diminution of the power required to propel a ship, in consequence of the alteration of the length of the parallel body, depended very largely on the coincidence, or want of coincidence, of the wave crests travelling alongside the ship with the points at which the reduction of breadth by the fine lines began. When this diminution coincided with a wave crest there was no loss, but rather a gain of speed; while when it coincided with a wave hollow the loss of speed, or increase of resistance, was considerable.

Mr. C. W. Merrifield regarded the paper as an extremely valuable contribution to our knowledge of the laws relating to ship resistance, and one which would materially help our conception of the operation of wave resistance. It was obvious that vessels must be designed for the special speed they were intended to run.

Sir William Thomson said that forty years ago, when the Association first met at Glasgow, there was a vague looking forward to such investigations as Mr. Froude has since carried out with such splendid results. They used to be interested in Mr. Scott Russell's ingenious experiments as to a connection between the forms of waves and the speed of ships, and Mr. Froude's research, although it had negatived some of Mr. Scott Russell's speculations, had shewn that there was a foundation of truth in them.

Professor Reynolds asked if Mr. Froude had examined any of Thorneycroft's torpedo

Mr. Froude said he had done so; and if they went much faster they would probably outrun the wave altogether. (Laughter.) If a ship possessed a fine form and good speed, she met with scarcely anything beyond skin resistance. She did not come in for less resistance at high speed except by a fluke. If she had fine ends, but a flatness in the middle, resistance could be reduced by widening the form of the middle—an anomaly for which he as yet had no explanation to offer.

Mr. J. R. Napier believed a comparatively short vessel with satisfactory ends, was preferable to a long crane thing. (Laughter.)

Mr. Froude said the fact that long ships did not pitch might redeem them from the condemnation to which Mr. Napier had subjected them.

After a few remarks from Professor

Everett and the President, Mr. Froude read a second paper on a new dynamometer for measuring the power delivered to the screws of large ships, the designing of which had been entrusted to him by the Admiralty. A short discussion ensued.

Other Papers &c., which demand notice are:—

MATHEMATICAL AND PHYSICAL SCIENCE.—A summary was given by Prof. Haughton of the results of the tidal observations made in the recent Arctic Expedition. The winter quarters of the *Discovery* proved to be a suitable locality for such observations, and a very complete series were taken, namely, an observation every hour for twenty-eight consecutive weeks, with exceedingly few omissions. These observations have been submitted, under Prof. Haughton's direction, to harmonic reduction; and the most interesting result is that, besides the two tides, one coming by way of Baffin's Bay, and the other by Behring's Straits, which were known to enter these seas, a third tide is found to be present. Each of these three tides has its own peculiar features. The Baffin's Bay tide is remarkable for the largeness of its diurnal component, the Behring's Straits tide has in like manner marks which render it unmistakable, and the third tide is distinguished by a feature which Prof. Haughton has never met with in any tide before, the largeness of the tertio-diurnal component—that is, the component whose period is eight hours. From the presence of this third tide Prof. Haughton draws the conclusion that Greenland is an island. Upon the whole, in the observations of the *Discovery*, the diurnal component had an amplitude of eight or nine inches, the semi-diurnal of fifty or fifty-four, and the tertio-diurnal of from four to six inches.

Among the communications made by Sir W. Thomson to the Section, perhaps the most important was that on the effect of transverse stress on the magnetic susceptibility of iron. It was known that a wire round which a current is sent by means of a helix, has its magnetization increased by applying a longitudinal pull. Sir William now finds that its magnetization would be diminished by applying a transverse pull. Such a pull cannot be directly applied to a wire, but the same end is attained indirectly by employed a gun-barrel instead of a wire, and subjecting it to strong hydrostatic pressure in its interior by means of water and a piston. Pressure so applied tends to increase the circumference of the barrel, and is thus equivalent to a circumferential pull. The effect is to render the barrel less susceptible to magnetization in the direction of its length.

Lord Rayleigh gave a paper describing experiments to determine the ultra-red limit of the prismatic spectrum. Prof. M'Leod gave the results of some very accurate measurements of the vibration-frequencies of Koenig's tuning-forks, by which they are completely vindicated from the charge of inaccuracy recently brought against them by Mr. Ellis. Mr. Stearn exhibited a new and apparently very convenient form of Sprengel's air-pump, the the fall-tube being only a few inches in length; and several short papers were contributed by that industrious young physicist, Mr. S. P. Thompson, of University College, Bristol. The underground temperature report contained observations from India, and a very extensive series from Schemnitz, in Hungary; and, besides the regular report on luminous meteors, there was a most sensational account of an enormous meteorite or mass of meteorites which fell in India, in October, 1873.

Though the section suspended its sitting on Saturday, on account of the attractive excursions which were fixed for that day; yet as it divided itself into two on Monday and Tuesday, it was thus enabled to complete a programme which was scarcely so extensive as usual.

CHEMISTRY—Prof. Odling brought several papers before the section, the most interesting being that "On Gallium." This metal, youngest of all elements, was discovered on the 27th of August, 1875, by Lecoq de Boisbaudran, in a zincblende from the mine of Pierrefitte, in the Pyrenees. The proportion of gallium in the ore amounted to one part in 100,000, and M. Lecoq de Boisbaudran had to employ half a ton of zinc before he got as much as twelve grains of metallic gallium. Gallium is of a greyish colour, something like lead, but not so blue. It, in fact, as regards colour, is more like pewter than any other metal. It tarnished slightly under exposure to the air; was not so soft as lead, but was capable of being bent, and cut with a knife. One of its most remarkable properties was that it could be heated to redness, when it assumed a very faint tarnish, without being converted into ash or scum. A more remarkable property was its extreme fusibility. It melted with the heat of the hand, and formed a globule of an extremely white colour, and would, if placed between two panes of glass, act like mercury by covering the surface, and affording a sort of mirror. A third remarkable property was its superfusion. It melted at a temperature of 30° but, on being allowed to cool very considerably below this temperature it did not solidify. It was one of the lighter metals—its specific gravity, which had been determined with great exactitude by its discoverer, being 4·7. It is isolated from its ore in the following manner:—The blende is dissolved in aqua regia; the solution is treated with zinc until nearly all evolution of hydrogen ceases, and the clear liquid decanted from the precipitate which has formed, and which contains copper, lead, silver, cadmium, mercury, thallium, &c. The clear liquid is now boiled with an excess of zinc until no more precipitate forms. This precipitate, which contains aluminium, zinc, and gallium, is re-dissolved in muriatic acid, and the solution, after addition to of some ammonic acetate, is treated with hydric sulphide for the purpose of precipitating the aluminium. The filtrate is now treated with sodic carbonate, which is added gradually and in small quantities. The first portions of the precipitate will contain the gallium. Spectroscopic inspection reveals the point where nothing more of this metal appears in the precipitate. The gallium has now to be separated from the zinc, and this is done by dissolving the last precipitate in hydro-chloric acid, and adding to the solution ammonia in excess, which throws down pure gallium oxide. This is now dissolved in potash, and subjected to electrolysis, when the gallium will appear at the negative electrode, coating the platinum, from which it is detached by bending the platinum under cold water.

Mr. J. M. Thomson gave a brief report "On Double Compounds of Nickel and Cobalt."

"On Peroxide of Hydrogen," by Mr. T. Fairley, was a review of work done in connection with this and other peroxides.

Dr. C. R. Alder Wright gave a summary of his researches on Aconitine. This alkaloid, and some others related to it, were prepared from *Aconitum ferox* and *A. Napellus*. The results obtained by the author and Mr. T. B. Groves, who investigated this subject some years ago, can be summarized in the following sentences:—

Aconitum Napellus roots, as met with in commerce, yield by appropriate means a highly active, well-crystallized alkaloid, aconitine, which is represented by the formula $C^{33}H^{43}NO^{12}$; the crystallized bodies obtained formerly by Groves (1860), and by Duquesnel (1871), consisted mainly of this base, but were not perfectly pure.

In one instance, roots purchased as *A. Napellus* yielded only a small quantity of aconitine, but a large amount of a nearly inert bitter base, *picraconitine*, forming well-crystallized salts, was present. The preparations usually met with in pharmacy under the name of "aconitine," or "nitrate of aconitine," must necessarily contain this inert base whenever it was present in the roots employed; consequently such pharmaceutical preparations cannot be relied on as of uniform physiological potency.

Besides *aconitine* and *picraconitine*, the roots of *A. Napellus* contain another alkaloid of lower molecular weight, and incapable of yielding crystalline salts or of crystallizing itself. Commercial "aconitine," when not crystallized, is liable to contain this substance as an impurity: thus the body examined by Von Planta appears to have almost wholly consisted of this amorphous, uncrystallizable substance, which is perhaps identical with or may contain the body "napelline," and other analogous substances described by other chemists.

The physiologically active crystallizable alkaloid of *A. Napellus (aconitine)* appears to be quite different from the crystallizable alkaloid of *A. ferox* (*pseudo-aconitine*), although the two are doubtless allied, and are similar in many of their properties. The inactive bitter base of *A. Napellus* (*picraconitine*) is not identical with Broughton's "artisine," from *A. heterophyllum*.

The use of strong mineral acids and other re-agents in the extraction of aconite alkaloids from the roots (as in the older processes) is likely to cause loss of crystallizable aconitine by alteration and decomposition; and to this cause is to be attributed the statement of chemists who have used such processes, that the alkaloid of *A. Napellus* is non-crystalline. It is not improbable that the "lycoctinine" and "acolyctine" of Hülschmann, from *A. lycoctonum*, are alteration-products thus formed. The tartaric acid process of Duquesnel is preferable; but as the first rough crystals of base thus produced are impure, and as it is difficult to separate the crystallized salts of aconitine and picraconitine, it would be desirable to re-crystallize the salts obtained by Duquesnel's method from ether, to convert the base-crystals into a salt, regenerate the alkaloid by soda carbonates, and finally crystallize again from ether. In this way a definite homogeneous subtance, possessing the physiological powers of aconite root in a high degree, could be obtained.

Aconitine is excessively energetic, so much so as to render working with it a matter of considerable pain and difficulty, unless very great care be taken in manipulation, and more especially in avoiding the inhaling of the dust of the crystals of the base or its salts. A minute fragment, too small to be seen, if accidentally blown into the eye, sets up the most painful irritation and lachrymation, lasting for hours; whilst similar particles, if inhaled, produce strong brochial irritation or considerable catarrh, according to the part where they lodge.

ANATOMY AND PHYSIOLOGY.—Professor Haughton's paper on the best possible number of limbs for terrestrial and aquatic animals attracted much notice. His reasonings were based on mathematical principles, and referred especially to ideal creatures, although many illustrations were drawn from actually existing animals. The three-limbed vertebrate was shown to be superior for stability and defence to any two or one-legged form; but the four-limbed vertebrate had the great advantage of enjoying perfect stability on any three limbs, while the fourth became available for offence. There was no advantage in having five or more limbs, except in special circumstances: the cost of feeding an extra limb outweighed the advantage of having it. Man lost something by being two-legged, but gained far more by the possession of hands wielded by reason. Birds again surrendered two legs for higher uses. Vertebrates that lived both in air and water possessed both the four legs of terrestrial forms and the single one (tail) of aquatic vertebrates. The Professor commenced the consideration of aquatic animals by conceiving a circular animal with a complete circle of small limbs, in which locomotion was attained by ordering particular limbs to cease working. This animal would have a perfect power of translation represented by 2 F (F being the muscular force of the body), but no rotation. A two-limbed swimmer with a circular form could swim in the direction of either limb with 2 F, and at right angles with 2 F; but it also had a power of rotation. The three-limbed form, with a symmetrical situation of the limbs, would exert $\frac{2}{3}$ F at each, and could swim with 2 F in six directions. The distinction between head and tail was then analyzed, and their possible mode of evolution indicated, the economical expenditure of force being the guiding principle. There was no economical advantage in an aquatic animal having a greater number of limbs than three; and the odd-limbed have always an advantage over the even-limbed, being able to travel in some directions with a smaller expenditure of force. As regards the principal force employed, the ordinary fish is really one-limbed, and goes forward with a force of 4 F, but cannot go backwards with anything like that force. The one-limbed form had the advantage that it could put on its entire power in one direction, but it was not as economical of energy as the three-limbed.

ANTHROPOLOGY.—Not a few of the papers read in the Antropological Department bore upon that branch of the science which is still generally known under the older name of Ethnology. Race-questions are always popular, since they are commonly connected with questions of politics and religion. At the present time, the ethnology of the Balkan Peninsula is peculiarly interesting, and the department therefore welcomed a paper "On the Bulgarians," by Dr. Beddoe, who has had the opportunity of personally studying their ethnic relations. These relations form a curious anthropological enigma, and Dr. Beddoe has followed Virchow and Kopernicki in seeking its solution. If the race-characters of a people could be determined at once from the language they speak, the problem would be easy enough, for it is well known that the Bulgarians speak a Sclavonic tongue, with little or no Turanian admixture, except what may reasonably be supposed to have been introduced by the Osmanli Turks. Yet it by no means follows from this that the Bulgarians are of Sclave blood. Indeed, as a matter of fact, their cranial characters differ extremely from those of Sclavonic type. It is believed that the Bulgars were originally a tribe from the Volga region, having apparently much in common with the Huns and Avars. But the Huns and Avars are considered to be of Turkish or of Finnish blood. And yet the Bulgarian skull does not resemble the ordinary Finnish type, while it is still less like the ordinary Turkish type of cranium. It stands, in fact, alone, its affinities being most obscure and leading merely to conjecture as to the ethnic relations of its possessors. A Bulgarian cranium examined by Dr. Beddoe had a cylindrical form, and a moderate breadth (77), with a small frontal and a large occipital region, whilst the face was slightly prognathous. In a cast of a Bulgarian skull, the author was struck with the extremely deep nasal notch and the remarkable shape of the nasal bones, indicating a patulous nose tilted upwards to an extraordinary degree; but it is only fair to remark that this seems to have been an exceptional example. Assuming, however, that the skull first described is typical, Dr. Beddoe endeavoured to use it as a guide in tracing the racial affinities of the Bulgarians. As the cranial features are neither Sclavic nor Turkish, he falls back upon the Finns, and is led to conjecture that they may be of Ugrian type. Indeed, he believes the modern Bulgarians to be as much Ugrian as anything else. How this Ugrian people came to assume the language of the subject Sclaves, over whom they once ruled in the Lower Danube, is explained by the author on Virchow's hypothesis, that when they received their religion from the Sclavic race, they became thoroughly welded with them, and allowed the Sclave language to supplant their own.

ZOOLOGY AND BOTANY.—Prof. Rolleston gave an account of some new points in the Zoology of New Guinea, especially referring to the new Echidna, which is named *E. Lawesei*, from the discoverer. Various zoological facts were adduced to show that Australia and New Guinea had formerly been connected by land. Several groups of animals, including the echidna and the cassowary, were found on both sides of Torres Strait. Although the tree kangaroo, found in New Guinea, was not now known in Australia, there were proofs of its former existence in the shape of marks on trees which could only have been produced by it. The striking differences between the vegetation of Australia and New Guinea was most probably due to the greater sensitiveness of plants, in certain circumstances, to physical conditions. The barren plains of Australia had a climate contrasting very much with the moist climate produced by the high mountains of New Guinea.

One of the papers that excited greatest interest was that by Mr. R. M'Lachlan, on the Colorado beetle. He described the history by which it has acquired its present fame, and the qualities which gave it such a predominance in the United States of and Canada. He said there was no native species in the British Isles that at all closely resembled it in ornamentation. With regard to the recent panic, there was as much necessity for legislation four or five years ago as now; the need of some legislation was real, but there was not a sufficient cause for the panic that had arisen. American animals as a rule could not be acclimatised in England, although American plants flourished most extensively. Another hope lay in the fact that we possessed a much greater number of insectivorous birds than North America; and the rook, absent in North America, had been especially pointed out as an enemy of this larva. Paris Green was the most effectual destroyer of the insect, without damage to the plants. In conclusion, Mr. M'Lachlan strongly advised that before sensational reports of the occurrence of the beetle were circulated, the advice of local naturalists should be sought. In the discussion which followed, Sir Willoughby Jones suggested that rooks, in common with other insectivorous birds, had a great distaste for the potato leaf, and that they probably would not be more disposed to eat the leaves when contained in the stomach of a larva than in the natural condition.

MECHANICAL SCIENCE.—The Report of the Committee for considering the Ordnance Datum of Great Britian was read by Mr. Shoolbred, who also contributed an explanatory paper on the subject. Sir William Thomson was the chairman, and it will be remembered that the Committee was appointed to investigate the causes of the uncertainties in this matter referred to in the communication made to the Association in 1875. The Committee came to the following conclusions:—

"1st. That of the two tide gauges at Liverpool now purporting to refer to the level of the Old Dock sill, the zero of that fixed at the south-east corner of the Canning Dock is about 5·64 inches above that on the river face of the Canning Island, Liverpool.

"2nd. That in order to reconcile the statement in the Ordnace Book of Levelling that the Datum Level for Great Britain is 8-10ths of an inch above the mean tidal level gauge on the St. George's Pier, Liverpool, with the actual facts which the Committee have collected, it is necessary to bear in mind that the records of the self-acting gauge referred to were the observations of one month only of the year 1859, and that the mean tidal level of that period was 7·8 inches below the mean of the decade 1864 to 1873.

"3rd. That the difference of levels between the Old Dock sill and the Ordnace datum, given in the Ordnance Book of Levelling as 4·67 feet, is correct on the assumption that the zero of the gauge on the face of the Canning Island, and not that of the gauge in the Canning Dock, be taken as the correct level of the Old Dock sill; and that, as stated in the Ordnance Book of Levelling, the Ordnance

datum be taken at 8-10ths of an inch above the mean tide level of the month of May 13 to June 14, 1859, as ascertained by the self-recording tide gauge of the Mersey Docks and Harbour Board.

"4th. It is thus apparent that the Ordnance datum is an entirely arbitrary level, which could not be again obtained from tidal observations."

The Committee further thought it advisable to take advantage of the present inquiry in order to obtain information as to some of the various local datum marks in use in the British Isles, and to endeavour to ascertain the difference of each relatively to the Ordnance datum, which would thus become a means of comparison between them. In order to enable the Committee to carry out this work, they asked to be re-appointed.

Capt. Douglas Galton then described the elevated railway in operation in New York, which provided for a rapid transit through streets in which the traffic was large. The line was carried on columns 9 inches in diameter, standing at distances of from 26 to 30 feet apart. Carriages moving at full speed could by means of an atmospheric break be stopped in about their own length. The line was economical as compared with the underground railway, the total cost per mile being about £55,000. Mr. Stevenson, of the Wantage steam tramway, explained his design for a suspension railway for street traffic. His proposed mode of construction consisted in the formation of a line of rails suspended from vertical bracketed columns, or from brackets projecting from buildings or archways, the columns, brackets, and bearings to be placed at convenient distances from each along the outer edge of the pavements in streets, or by the side of the highways. The great dissimilarity of the invention from ordinary railways on street tramways was in the particular formation of the permanent way, which would be supported by clip suspension. The cost would not exceed £3,000 per mile.

Sir William Thomson drew attention to the importance of giving a distinctive character to the Needles' light, and submitted to the Section an improvement on his method of taking flying soundings as described at an earlier meeting of the Section. Instead of using the reaction of sulphate of iron and prussiate of potash for marking the pressure in the glass tube, he has succeeded in omitting the sulphate of iron, and using the water of the sea instead. The tube is lined with prussiate of potash as before, which is treated with a solution of nitrate of silver, by means of which a film is formed, which leaves a deposit of metallic silver in the tube, wherever brought into contact with the sea-water, as it rises under the pressure due to the depth to which the tube is sunk.

The Eddystone Lighthouse was then described by Mr. J. N. Douglas, who somewhat startled the audience by the intelligence that, owing to the wearing away of the rock foundation, Smeaton's marvellous edifice is doomed, and that the Trinity House have decided to take it down, and to erect another in its stead.

The Section met on Wednesday to complete the reading of papers left standing over from the previous day.

Mr. F. J. Bramwell described the method by which the asylum at Banstead has been heated, and stated that the water was heated from one source and circulated throughout the building by means of a centrifugal pump. The most efficacious results had been attained; and as the asylum was constructed on the pavilion or separate system, the temperature in one section could be altered without interfering with that in the others. The water was derived from a deep well in the chalk, and was of about seventeen degrees of hardness. For general domestic purposes, and in order to prevent the deterioration of the heating apparatus, soft water was necessary, and the conversion was made by Dr. Clarke's process, as carried out by Mr. Porter, and that, too, with perfect success.

M. Bergeron, a French civil engineer, read a paper, in which he explained some experiments that he made at Boulogne on his system for removing sand bars at the mouths of sea harbours—a system which was before the Section on a former occasion, consisting in principle of small streams of water ejected from laternal holes in pipes laid on the sand. The French Government consented to try the method on a large scale, but as the credit of 10,000 francs was exhausted before the experiments were completed, definite results were not obtained. Sufficient occurred, however, to demonstrate that when the bar was exposed at low spring tide it could be sensibly diminished.

Mr. Loftus Perkins then read a paper "On a new form of High Pressure Steam-engine," remarking that to make an engine which would work with safety at a pressure of a thousand pounds might appear difficult, but it was not really so when the boiler was constructed with tubes of small diameter. The higher the pressure the greater the power that could be obtained from a given quantity of steam; therefore, the higher the pressure the greater the economy of fuel. One important point connected with the boiler he had invented was its absolute safety. Such an accident as happened to the *Thunderer* was impossible with it, and he hoped the Admiralty and private owners of steam machinery would become impressed with the fact that disasters of that character could with certainty be prevented. The boiler could be so designed that all its parts would be interchangeable. It would never prime, and there was no necessity for the usual blow-through and relief valves.

Mr. F. N. Varley read a brief paper "On Electric Block Telegraphs," which we trust he will enable us to give a more complete notice of, and the proceedings of the Section were concluded with the usual votes of thanks.

THE HUMAN MACHINE AND ITS FUEL.

DR. JOULE has pointed out that not only does an animal much more nearly resemble in its functions an electromagnetic engine than it resembles a steam engine, but he also has stated that it is a much more efficient engine—"that is to say," says Professor Tait, "an animal, for the same amount of potential energy of food or fuel supplied to it, gives you a larger amount converted into work than any engine which we can construct physically." In other words, the duty—by which we mean the percentage of the energy of the fuel which it can convert into the useful or desired form—is greater in the case of animal mechanism than in that of any other engine in which fuel is employed. The work we obtain in the form of heat, constructive power, nervo-muscular action, mechanical motion, and the like, and here the analogy between the body and a machine ends, because the food in the animal is not merely a source of energy, but it enters into the development and maintenance of the body itself. It follows, therefore, that two classes of food are necessary; first, the organic, which alone is oxidizable or capable of generating potential energy, and secondly, the inorganic, which, though not oxidizable, is essentially the metamorphosis of organic matter which takes place in the animal economy. The organic constituents of food are generally divided into nitrogenous, fatty, and saccharine compounds, and the inorganic into water and saline matters.

Taking up these constituents in their order, Dr. George Wilson, in his recent admirable work, "A Handbook of Hygiene," states that the nitrogenous portions of food have for their main functions the construction and repair of tissues, besides possessing other functions of a regulative and dynamic nature not well defined. Fatty constituents play an important part in the maintenance of animal heat and in the conversion of food into tissue. The oxidation of fat in the blood generates to a great extent the energy which is rendered apparent in locomotion and manual labour. It, besides, renders the human machine elastic, and supplies lubricating material. The saccharine constituents of hydro-carbons (cellulose, starch, and sugar) are directly subservient to the maintenance of animal heat and the production of animal energy. Water in the animal economy dissolves and conveys food to different parts of the system, removes effete products, lubricates the tissues, equalizes the bodily temperature by evaporation, and regulates the chemical changes which take place in the processes of nutrition and decay. Saline matters, on the other hand, are the chief media for the transference of the organic constituents throughout the body. They are largely concerned in the consolidation of the tissues, and are supposed to convert unabsorbable colloids into highly diffusive crystalloids.

As we have already stated, the potential energy of food is the sole source of the active energy displayed in the mechanical motion or work. And consequently, up to certain limits, the diet must be increased as the work increases. The question for the economist is then, first, on how much food can a man subsist and live: and second, how much more food must be added when certain work is to be performed. Dr. Edward Smith has determined that the Lancashire operatives during the cotton famine managed to live on 3,888 grains of carbon and 181 grains of nitrogen per day. This is equivalent to about 2 lbs. of baker's bread. On the other hand, a man who could live on this amount during idleness, while at work requires (according to Dr. Letheby) 6,823 grains of carbon, and 391 grains of nitrogen. This is equivalent to 2 lbs. of beef, with 1 lb. of potatoes, 1 lb. of beer, and about ½ lb. of sugar.

Of course the quantity of the food required differs not merely with the amount of work done, but with its quality. Dr.

Smith has prepared a table showing the weekly dietaries of low-fed operatives. Needlewomen, for example, in London average 124 ozs. breadstuffs, 40 ozs. potatoes, 7·3ozs. fats, 16·3ozs. meat, 7·0ozs. milk, 0·5 oz. cheese, and 1·3 ozs. tea per week. This diet is richer in meat than that of the English farm labourer. The Macclesfield silk weavers are quoted at 3·2ozs. meat per week. The Irish farm labourer gets but 4·5ozs. meat weekly, but he has 326 ozs. breadstuffs and 135 ozs. milk. The Scotch farm worker eats over twice as much potatoes as the Irishman, despite the supposed fact that the tubers constitute the principal article of diet among the peasantry of the Emerald Isle. The table compiled by Dr. Smith includes silk weavers, shoemakers, farm labourers, and needlewomen, and the average diet per day for all is 4,881 grains of carbon and 214 grains of nitrogen. We can contrast with this, data obtained by Dr. Playfair covering the diets of English railway navvies, English and French sailors, soldiers in peace, prizefighters, hard-worked weavers, and blacksmiths. This shows that the average is 5,837 grains of carbon and 400 grains of nitrogen per individual per day. There are many suggestive comparisons to be made here. Take for example the figures relative to weavers. There is one class of these operatives who do light work on a daily average of 3,861 grains of carbon and 157 grains of nitrogen; when at hard work, this becomes 6,020 grains of carbon and 375 grains of nitrogen. As shown above, the first-mentioned quantities are no more than barely sufficient to sustain the body; and work here practically means a wearing away of the human machine. Now when the work becomes harder, 2,159 grains of carbon and 218 grains of nitrogen more are consumed; and these are the food equivalent for the extra work performed. In the case of the prizefighter in training, he daily average in point of carbonaceous matter is less than that of the low-fed operative, but the nitrogenous matter—flesh and muscle manufacturing material—the average is 690 grains, or over three times greater. The proportions of the training athlete's daily food are flesh formers 9·8 ozs., fats 3·1 ozs., starch and sugar 3·27 ozs.

It will be seen from the foregoing that it is quite possible to construct dietaries, especially suited to sustaining the animal mechanism, in accordance with the work to be accomplished. This subject we shall consider is another article.

POTASSIC XANTHOXATE.

This salt, the remarkable antiseptic properties of which were noted in a recent issue of the *Scientific American*, may be prepared by adding carbonic disulphide to an alcoholic solution of potash, or by the action of potassic sulphydrate on neutral ethylic disulphocarbonate. If fused hydrate of potassium is dissolved in half its weight of absolute alcohol, and carbonic disulphide is added slowly till the liquid no longer exhibits an alkaline reaction, and the mixture is cooled to 32° Fah., the xanthate of potassium separates in colourless needles; and an additional quantity may be obtained by evaporating the mother liquor in a vacuum, after the excess of carbonic disulphide has been separated by water. But the salt is most easily prepared by adding to absolute alcohol an excess of very pure caustic potash, and then an excess of carbonic disulphide. The mixture immediately solidifies to a mass of interlaced silky needles, which must be washed on a filter with ether to free them from bisulphide of carbon, then pressed between bibulous paper, and dried over oil of vitriol. The salt crystallizes in shining, colourless prisms, which turn slightly yellow on exposure to the air. It is very soluble in water, and dissolves readily in 5 or 6 parts of absolute alcohol. It is insoluble, or nearly so, in ether. Its solution in absolute alcohol is not affected by boiling, but its aqueous solution decomposes when heated above 122° Fah., yielding potassic trisulphocarbonate, alcohol, sulphuretted hydrogen, and carbonic acid, thus: $2C_3H_5KOS_2 + 2H_2O = K_2CS_3 + 2C\ H_6O + H_2S + CO_2$. In the dry state, it may be heated to 200° without alteration; but at higher temperatures it gives off ethylic sulphydrate, sulphuretted hydrogen, water, and carbonic oxide, leaving a residue of potassic sulphide, mixed with charcoal. The solution heated with potash is resolved into mercaptan and potassic ethylmonosulphocarbonate. Strong nitric acid decomposes it with violence. Xanthate of sodium forms yellow needle-like crystals, resembling those of the potash salt, but of a darker colour. The solutions of these salts form a yellow precipitate with salts of lead; yellow with copper salts (hence the name of the acid); light yellow with silver nitrate and mercurous salts; the last mentioned, however, quickly becomes brown and black.

A MIMIC UNIVERSE.

Recently Professor C. B. Boyle exhibited before a few prominent members of the American Geographical Society a very ingenious instrument of his own invention, which shows the precession of the equinoxes, the portions of the globe which are illuminated by the sun at all seasons of the year, and, of course, in every point of its orbit. The instrument also shows the gradual variation of the inclination of the earth's axis to the ecliptic, and the circle which it would make in the heavens in the course of a grand cycle of time, 25,000 years. The following description of this philosophic application of the mechanical powers is from the inventor himself:—

"The instrument was suggested by a conversation of Chief Justice Daly with the inventor upon the subject of the precession of the equinoxes, and though it was originally designed to render literal interpretation of the facts involved in that phase of our earth's relation to the sun, yet it presents with equal precision all the other facts of motion and their attendant phenomena. The sun is represented by a flame, situated a few inches above the centre of a round table upon which is figured a star chart, bounded by the twelve stars of the zodiac. The outer end of a slender arm extending from the centre is surrounded by a globe, upon which the light emitted by the flame is condensed by a lens. As this light steadily illuminates the hemisphere of the globe which is turned towards it, and as the axis about which the globe rotates is poised at the same angle of inclination to the plane of its orbit as that of the earth is to the plane of its orbit about the sun, it follows that precisely the same phases of illumination are presented upon both globes. The rising and setting of the sun, the changing lengths of day and night in different latitudes, the changes of the seasons, the long polar night and day, are all seen to occur in their proper order of succession. The eccentricity of the orbit with the sun in one of the foci of the ellipse, and the shifting of the direction of that eccentricity among the stars is also presented. When the mimic moon is added, the eclipses of that body and of the sun present themselves, the shadow of the moon passing across the globe, first near the pole, and at each successive lunation lowers down until it passes off at the opposite pole, thenceforward the shadow of the moon passing into space clear of the globe until the combined mutations bring back the period of eclipses, thus presenting the facts successively as they occur in nature. An additional arm carries a comet so near the centre as to nearly graze the mimic sun at its perihelion, whence it departs to its aphelion distance in far off space, thence returning as before to the sun.

"At the instant the globe is passing its vernal equinox a bell is struck—a single blow, which, at each revolution of the globe about the centre, calls attention to that fact, so that the observer may see that the globe is in its equinox at the stroke of the bell, and note also that the equinox has slightly shifted its place upon the ecliptic—receded upon the star chart—gone backward in the sign of the zodiac in which it is then occurring, which slow shifting finally carries the equinoxes about the entire circle of the heavens, and, at the same time, changes the direction of the globe's axis of rotation, which returns to its original direction when the equinoxes return to their original position among the stars.—*New York Herald.*

SOMNIUM TERRÂ MARIQUE.

To Ianthe.

I rested on a grassy mead,
  And watched the bright blue sea
Roll in the Solent wave on wave,
  And thought of thine and thee.

Whose bosom, white with many a sail,
  Bore ship round by the lea;
I sighed and thought; Oh, would that one
  Would bear my love to me!

Loud sang the lark her carol high,
  And seemed to sing to me!
But still methought no song so sweet
  As my love's voice to me!

A pheasant woke from out the brake,
  And called in accents free;
As if to seek a kindred mate,
  And pined, as I for thee.

The wind woke rustling round the mead,
  And stole from tree to tree:
I called, and said; Oh bear me now,
  Or waft my love to me!

When from the acacia's waving palm
  A leaf fell as from thee:
Oh love, I said, is this the spell
  Thy spirit's sent to me?

A river rippled neath my feet
  'Mid myrtle and lily,
And seemed to "syllable thy name,"
  And whisper words from thee!

I made a wreath of simple flowers,
  And twined thy name; to be
The symbol of our silent love,
  To blossom there for thee.

Vecta. Henry George Hellon.

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